C²I² Systems

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Communications
Computer Intelligence
Integration

User Manual

for the

16-Channel CompactPCI Adapter

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Abbreviations and Acronyms

CD	Carrier Detect
CTS	Clear to Send
DIP	Dual In-line Package
DSR	Data Set Ready
DTR	Data Terminal Ready
GND	Signal Ground
HCC	Host Carrier Card
I/O	Input / Output
INT	Interrupt
MHz	MegaHertz
PCB	Printed Circuit Board
PCI	Peripheral Component Interconnect
cPCI	Compact PCI
RI	Ring Indicator
RS-232	(Electronics Industries Association) Recommended Standard 232, or : EIA-232
RS-422	(Electronics Industries Association) Recommended Standard 422, or : EIA-422
RTS	Request To Send
Rx	Receive
Tx	Transmit
UART	Universal Asynchronous Receiver Transmitter
URL	Uniform Resource Locator

1. Introduction and Scope

1.1 Introduction

The CCII 16-Channel CompactPCI Adapter provides a PCI to 16-Channel Serial UART interface. Complete galvanically isolated transceivers provide 2500 V_{RMS} of isolation between the line transceiver and the logic interface for all 16 channels. Channels 1 - 8 operate in RS-232 mode where channels 9 - 16 are user configurable in either RS-232 or RS-422 modes of operation. Serial channel configuration (RS-232 or RS-422 electrical modes) is set with an onboard DIP switch. PCI interrupt selection is possible through two separate DIP switches.

1.2 Scope

This document briefly describes the architecture of the 16-Channel CompactPCI Adapter and provides software driver installation instructions in the annexure.

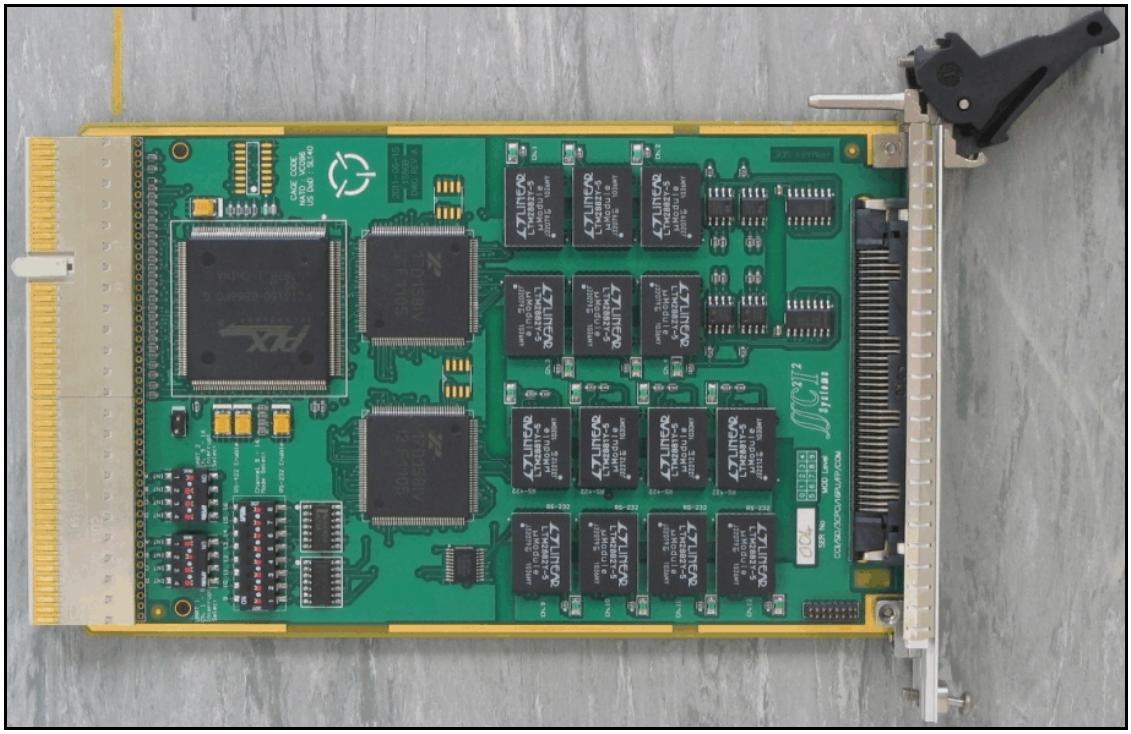

Figure 1 : 16-Channel CompactPCI Adapter

2. Applicable and Reference Documents

2.1 Applicable Documents

2.1.1 EXAR Corporation Datasheet, *EXAR XR17D158 Universal (3.3V and 5V) PCI Bus Octal UART*, Revision 1.2.2, dated August 2005.

2.1.2 LINEAR Technology Datasheet, *LTM2882, Dual Isolated RS232 µModule Transceiver + Power*.

2.1.3 LINEAR Technology Datasheet, *LTM2881, Complete Isolated RS485/RS422 µModule Transceiver + Power*.

2.1.4 MAXIM Semiconductors Datasheet, *±15kV ESD-Protected, Quad, Low-Power RS-232 Line Receiver*, Revision 1, dated Feb 2003.

2.1.5 Fairchild Semiconductor Datasheet, *HCPL0XXX - High Speed Transistor Optocouplers,* Revision 1.0.4, dated April 2009.

2.1.6 Texas Instruments Datasheet, *SN65C3243, SN75C3243 3-V to 5.5-V Multichannel RS-232 Compatible Line Driver/Receiver,* Revision SLLS353G, dated November 2004.

2.1.7 PLX Technology Datasheet, *PCI 6150, PCI-to-PCI Bridge, High-Performance, Asynchronous 32-Bit, 66 MHz PCI-to-PCI Bridge for Servers, Storage, Telecommunication, Networking and Embedded Applications,* Revision 3.0, dated July 2007.

2.2 Reference Documents

2.2.1 C²I² Systems Interface Control Document, *Serial I/O Cable for the 16-Channel CompactPCI Adapter*, CCII/LCP/6-SICD/001, Revision 0.1, dated June 2011.

2.3 Specifications

2.3.1 PCI Special Interest Group, *PCI Local Bus Specification*, Revision 2.3, dated 2002-03-29.

2.3.2 PCI Industrial Computers Manufacturers Group, *CompactPCI Specification*, PICMG 2.0 R3.0, dated 1999-10-01.

3. Architecture

3.1 System Overview

The 16-Channel Serial I/O Adapter has eight asynchronous RS-232 serial channels and another eight asynchronous, RS-232 or RS-422 configurable serial channels. Channels are configured with a DIP switch located on the adapter. The serial I/O interface of the adapter is routed externally via the 160-pin Molex frontpanel I/O connector and can be accessed with the optional CCII 16-Channel Serial I/O Cable (CCII/LCP/6-SICD/001).

Channels 1 - 8 support RS-232 and channels 9 - 16 support RS-232 or RS-422. Channels 1 - 8 are each allocated the eight standard modem signals (TxD, RxD, CTS, RTS, DSR, DTR, RI and CD) in RS-232 mode. Channels 9 - 16 each have a reduced number of signals in RS-232 mode (only TxD, RxD, CTS and RTS) and RS-422 mode (only Tx+, Tx-, Rx+ and Rx-).

A block diagram of the 16-Channel CompactPCI Adapter is shown in Figure 2.

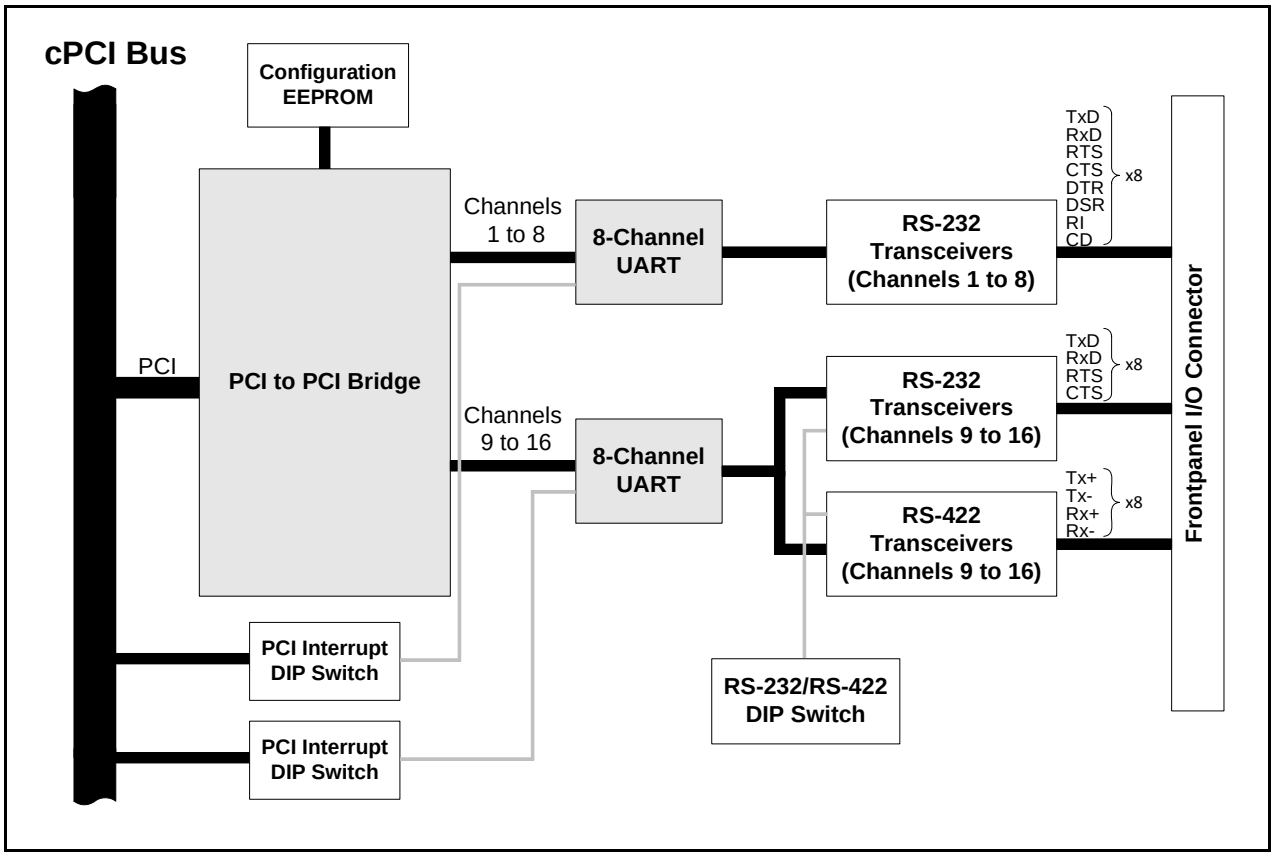

Figure 2 : Functional Block Diagram of the 16-Channel CompactPCI Adapter

3.2 CompactPCI Bus

The 16-Channel CompactPCI Adapter can be installed on any host conforming to the PCIMG 2.0 specification and which supports Universal PCI signalling (either 3,3 V or 5,0 V).

The adapter supports 32-bit PCI communications. The CompactPCI interface is implemented using a PCI-to-PCI bridge and supports PCI bus speeds of 33 MHz or 66 MHz.

3.3 CompactPCI Connectors

The 16-Channel Serial I/O Adapter has one rear connector which implements the 32-bit, 66 MHz CompactPCI interface.

3.4 PCI-to-PCI Bridge

The 16-Channel CompactPCI Adapter incorporates a transparent PCI-to-PCI bridge for bus expansion, enabling the use of two 8-Channel UART devices.

3.5 PCI 8-Channel UART

The octal PCI bus Universal Asynchronous Receiver and Transmitter (UART) has a global interrupt source register which provides complete interrupt status indication for all 8 channels to speed up interrupt parsing. Each UART has its own 16C550-compatible configuration register set and features the following :

- transmit and receive FIFOs of 64 bytes each
- fully programmable transmit and receive FIFO trigger levels
- transmit and receive FIFO level counters
- automatic RTS/CTS or DTR/DSR hardware flow control with programmable hysteresis levels
- automatic software (Xon/Xoff) flow control
- a 16-bit general purpose timer/counter

3.6 PCI Interrupt

The CompactPCI Adapter supports all four PCI interrupts and they can be assigned to each UART via the two onboard DIP switches. The default DIP switch configuration for the interrupts are shown in Figure 3 below.

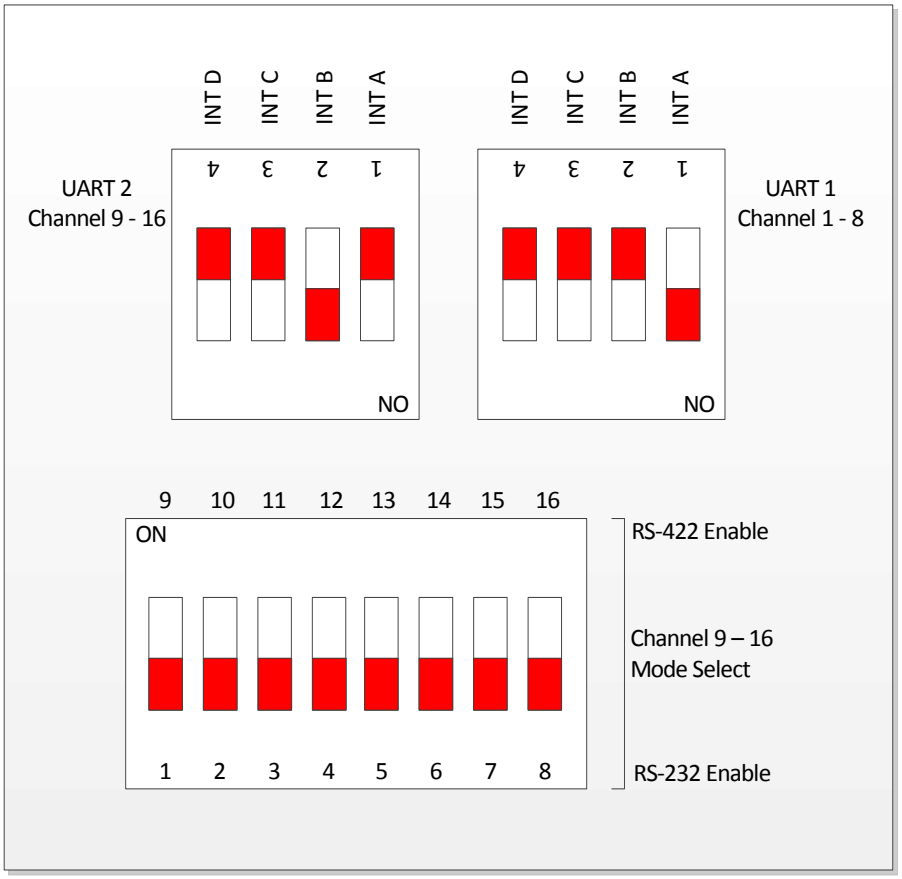

Figure 3 : PCI Interrupt & Serial Channel Configuration DIP Switches

3.7 RS-232 Transceivers

Each RS-232 transceiver can transmit / receive serial data at rates of up to 1 Mbit/s (which is the maximum data rate supported by the RS-232 transceivers) over distances of up to ten metres.

The PCI UART devices can however be configured to communicate at much faster data rates (up to 6,25 Mbit/s per channel). Care should thus be taken to ensure that user software limits RS-232 data rates to a maximum of 1 Mbit/s.

3.8 RS-422 Transceivers

Each RS-422 transceiver can transmit / receive serial data up to the maximum UART data rate of 6,25 Mbit/s over distances of up to one hundred metres. Transmission distances of up to one kilometre are possible at lower data rates.

3.9 Serial Channel Configuration DIP Switch

Refer to Figure 3 for the DIP switch configuration. Channels 9 - 16 can be set independently to either RS-232 or RS-422 mode. For RS-232 each serial channel's respective switch must be in the OFF position while RS-422 requires it to be in the ON position.

3.10 160-pin Frontpanel I/O Connector

The serial I/O interface of the adapter is routed externally via a 160-pin Molex frontpanel I/O connector. Refer to Figure 4 for pin numbering. For full frontpanel connector pin assignments please refer to the Interface Control Document [2.2.1].

The 16-Channel CompactPCI Adapter uses Molex connector part number: 71624-3000

The 16-Channel Serial I/O Cable uses mating Molex connector part number: 71626-4000

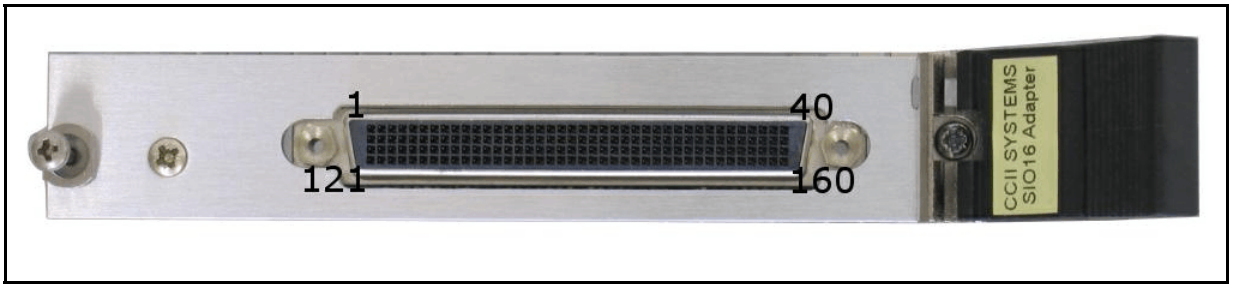

Figure 4 : 160-pin Frontpanel I/O Connector

3.11 16-Channel Serial I/O Cable

An optional CCII 16-Channel Serial I/O Cable (CCII/LCP/6-SICD/001) is available for this adapter. For pin assignments please refer to the Interface Control Document [2.2.1].

Figure 5 : 16-Channel Serial I/O Cable

Annexure A

Software Driver Installation Instructions

Device drivers for the 16-Channel CompactPCI Adapter can be found on the supplied disc under [Drivers\SIO16\...] or on the C²I² Systems website at the following URL, http://www.ccii.co.za/drivers/index.html#SIO16. Save the files to disk then follow the instructions below.

A.1 Windows

After the adapter is installed into the PC and started up, Windows will detect the new hardware and request drivers for the UART devices and their serial channels. Choose manual installation of the drivers and install from specific location.

Found New Hardware Wizard
Welcome to the Found New Hardware Wizard
Windows will search for current and updated software by looking on your computer, on the hardware installation CD, or on the Windows Update Web site (with your permission).
Read our privacy policy
Can Windows connect to Windows Update to search for software?
Yes, this time only
Yes, now and every time I connect a device
No, not this time
Click Next to continue.
< Back
Next >
Cancel

Select the location with the appropriate INF file for your version of Windows. Please refer to the included readme file in the appropriate driver archive for an explanation of which INF file to use.

Found New Hardware Wizard
Please choose your search and installation options.
Search for the best driver in these locations.
Use the check boxes below to limit or expand the default search, which includes local paths and removable media. The best driver found will be installed.
Search removable media (floppy, CD-ROM...)
Include this location in the search:
C:\...\Com5_14.7
Browse
Don't search. I will choose the driver to install.
Choose this option to select the device driver from a list. Windows does not guarantee that the driver you choose will be the best match for your hardware.
< Back
Next >
Cancel

Two UART devices will be detected and installed.

Found New Hardware Wizard
Completing the Found New Hardware Wizard
The wizard has finished installing the software for:
OEM's 8-Port UART PCI Card
Click Finish to close the wizard.
< Back
Finish
Cancel

The 16 serial channels need to be installed individually.

The adapter should start working immediately after the installation is complete.

A.2 Linux

Most Linux distributions are configured to support a maximum of eight serial ports. A new Linux Kernel will have to be configured and compiled to add support for more serial ports. Instructions on how to do this will be given below. It should be noted that these instructions are for Linux V2.6.x and have not been tested on newer versions. It is also assumed that the user is familiar with the following documents:

- Serial-HOWTO
- Kernel-HOWTO

I. Download the full Linux Kernel Source from http://www.kernel.org/ and copy to a temporary location on your Linux machine. Make sure that you are in root mode.

II. Extract the archive from the temporary location with the following command:

```
# tar -xjvf linux-x.y.z.p.tar.bz2 -C /usr/src
```

III. Change directory to the source code and configure the kernel:

```
# cd /usr/src/linux-x.y.z.p

# make menuconfig
```

IV. You should now be in the kernel configuration menu. Navigate to the following sub-menu,

```
Device Drivers –> Character Devices –> Serial Drivers
```

and edit the following fields to the indicated values:

```
Maximum number of 8250/16550 serial ports = 16 + number of ports already in use

Number of 8250/16550 serial ports to register at runtime = 16 + number of ports already in use
```

Make other necessary configuration changes required by your setup then exit and save your changes.

V. Compile the kernel with the following commands:

```
# make

# make modules_install install
```

(Note: Compiling the kernel can take a few hours to complete.)

VI. Reboot your Linux machine.

```
# reboot
```

Linux V2.6.x has built-in support for the standard 16C550 UART and shouldn't require a software driver installation. If needed, drivers are included on the supplied disc under [Drivers\SIO16\Linux...] or on the C²I² Systems website.